Stem Cells

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What is a Stem Cell?

- Undifferentiated
- High proliferative capacity
- Ability to give rise to more specialized daughter cells and more stem cells

Types of Stem Cells

- Adult stem cells
  - bone marrow
  - skin
  - intestinal lining
  - skeletal muscle
  - neural
- Embryonic stem cells
- Germ cells

A Quick Stem Cell Comparison

Adult

- Autologous cells available
- No immunosuppression needed
- Limited ability to form critical cell types
- Problems with scaling to clinical requirements

Embryonic

- Immunosuppression required for foreseeable future
- Unlimited ability to form different cell types
- Risk of tumor formation
- Can be grown to clinical scale

U.S. Public Health Hospital, Seattle
Site of the first successful stem cell transplants
(among non-identical twins)

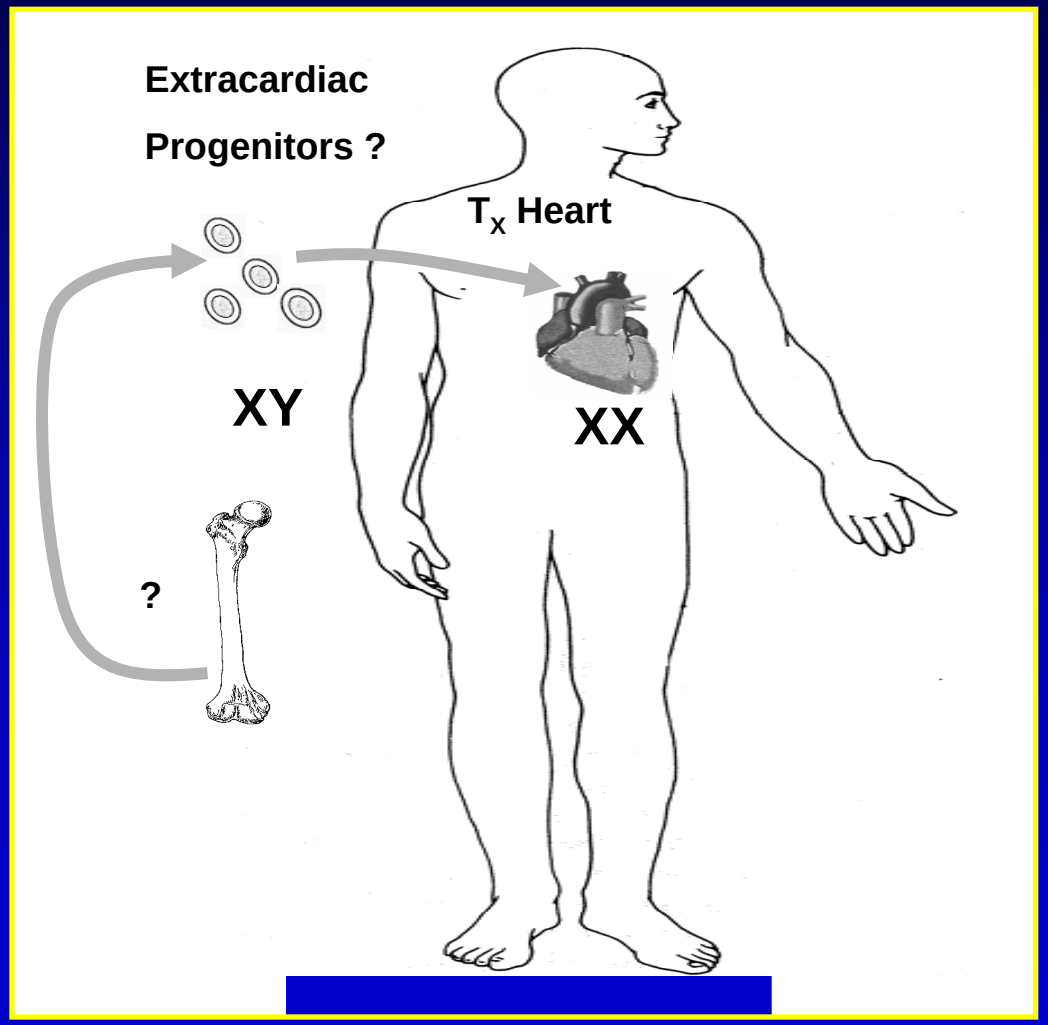
Amazon.com

1990 Nobel Prize for Medicine

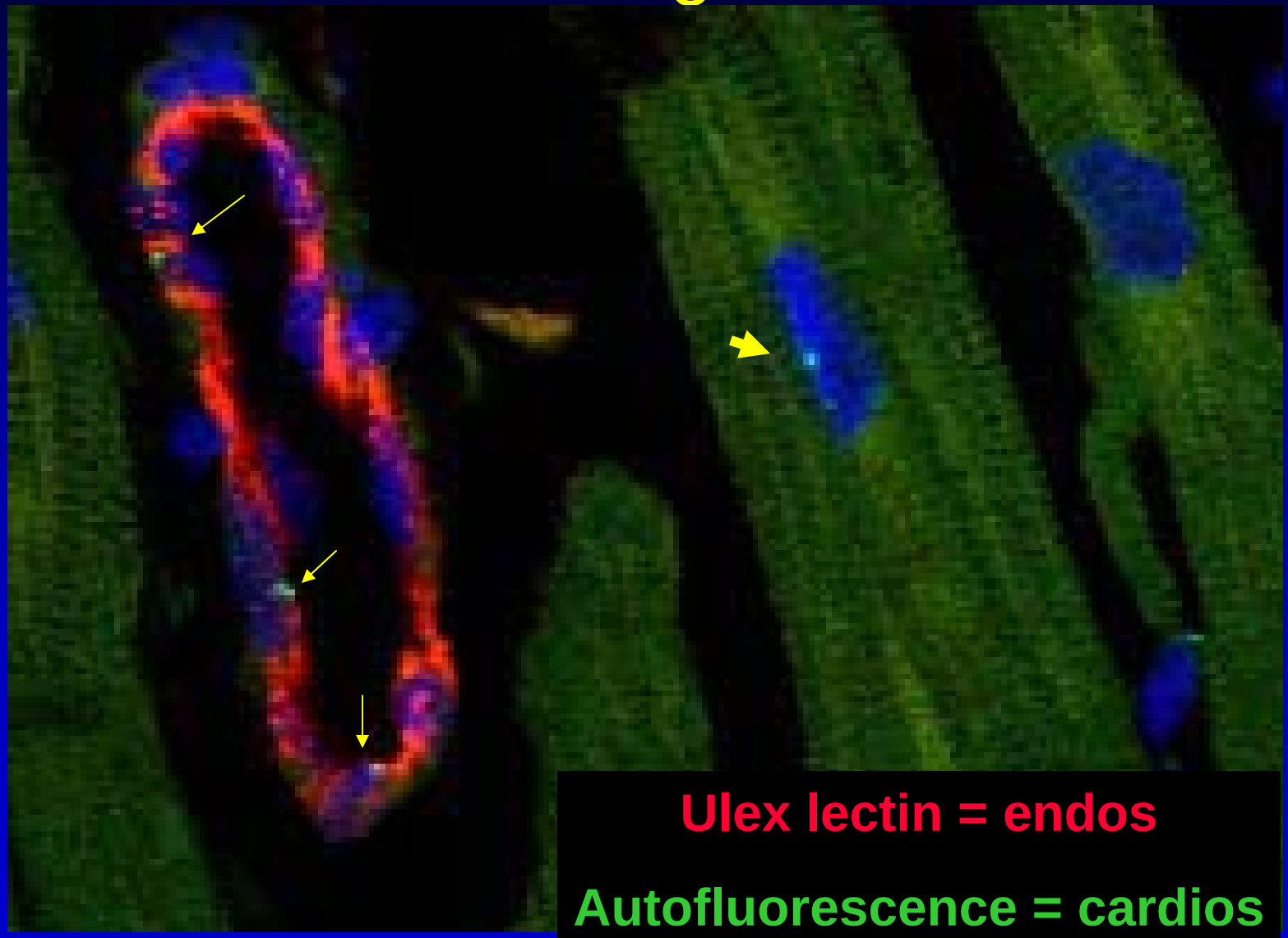
Joseph E. Murray

E. Donnall Thomas

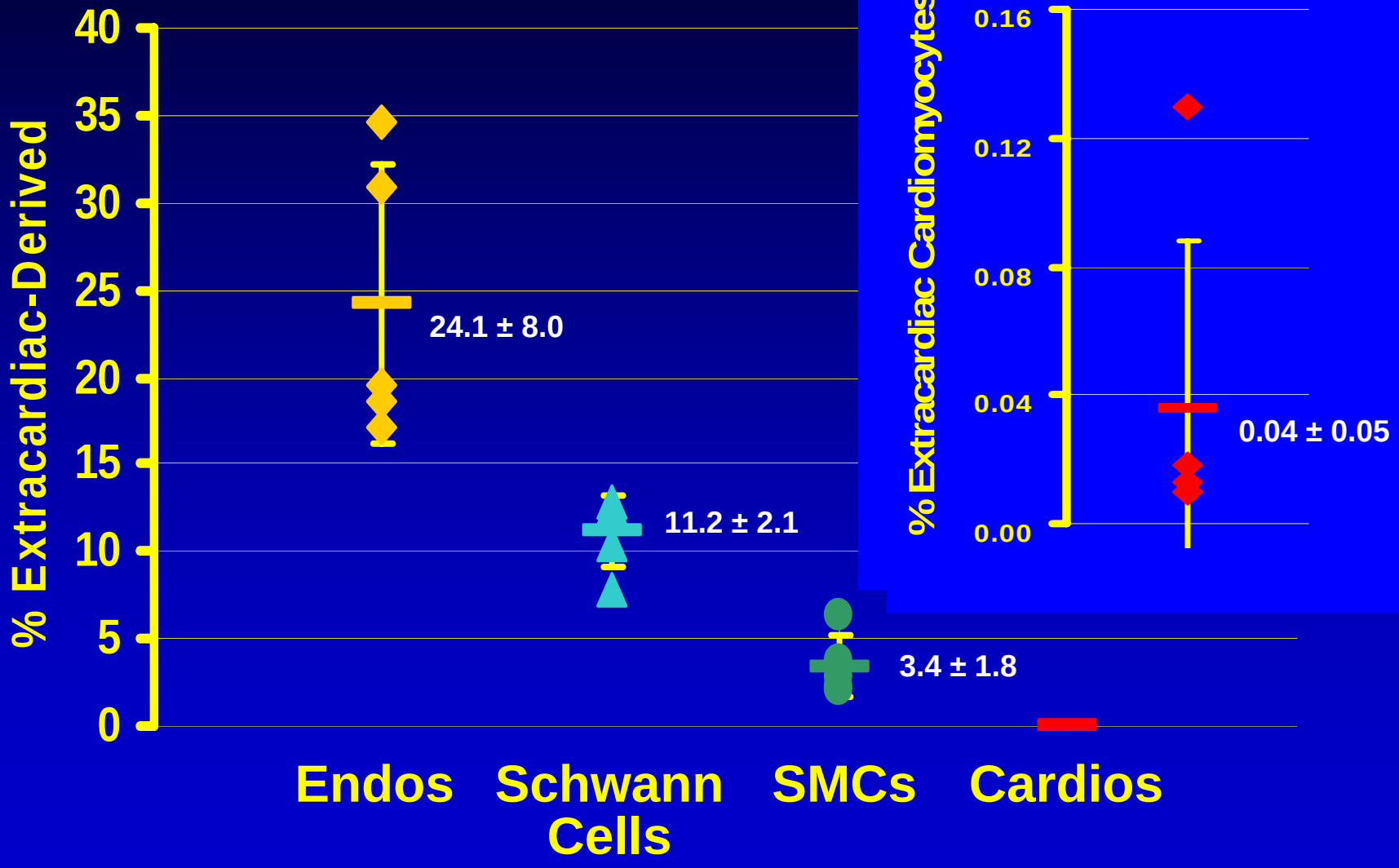
Using Heart Transplantation To Track Stem Cells in the Heart



Vascular and Muscle Cells from Circulating Stem Cells



Summary of Myocardial Repopulation



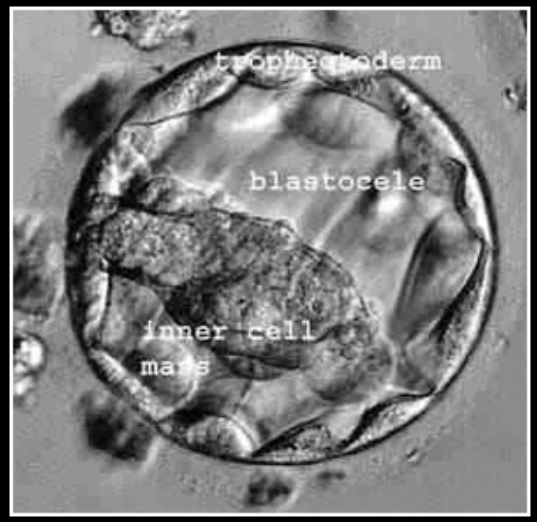
Conclusions

- Adult stem cells from marrow contribute to growth of new blood vessels.
- They do not contribute significantly to growth of new cardiac muscle cells, either through the circulation or after direct injection into the heart.

Early Mammalian Development

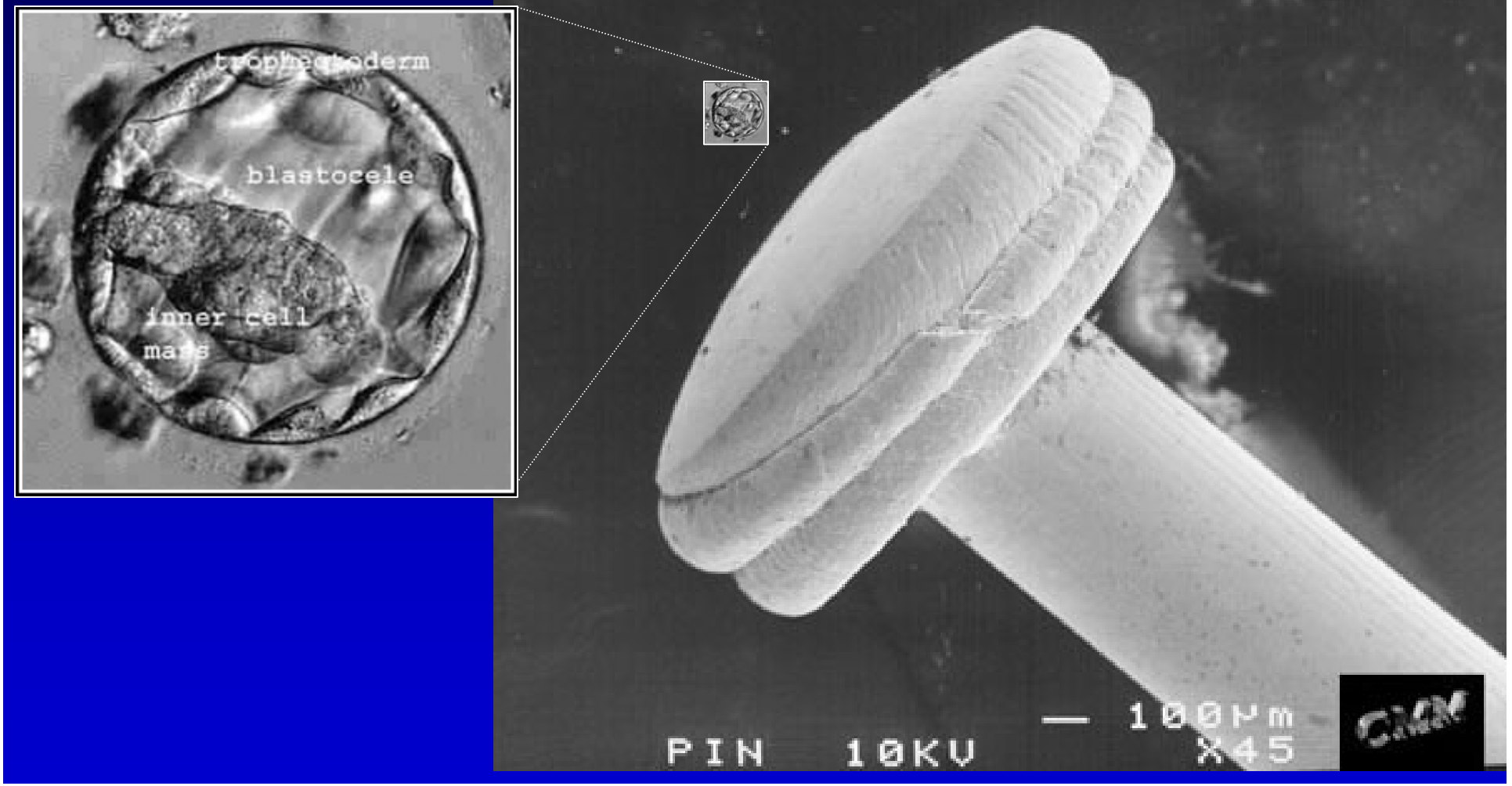
Zygote

Morula



Blastocyst

Embryonic Stem Cells:
A Sense of Scale



Embryonic Stem Cells

Beating Heart Muscle Movie

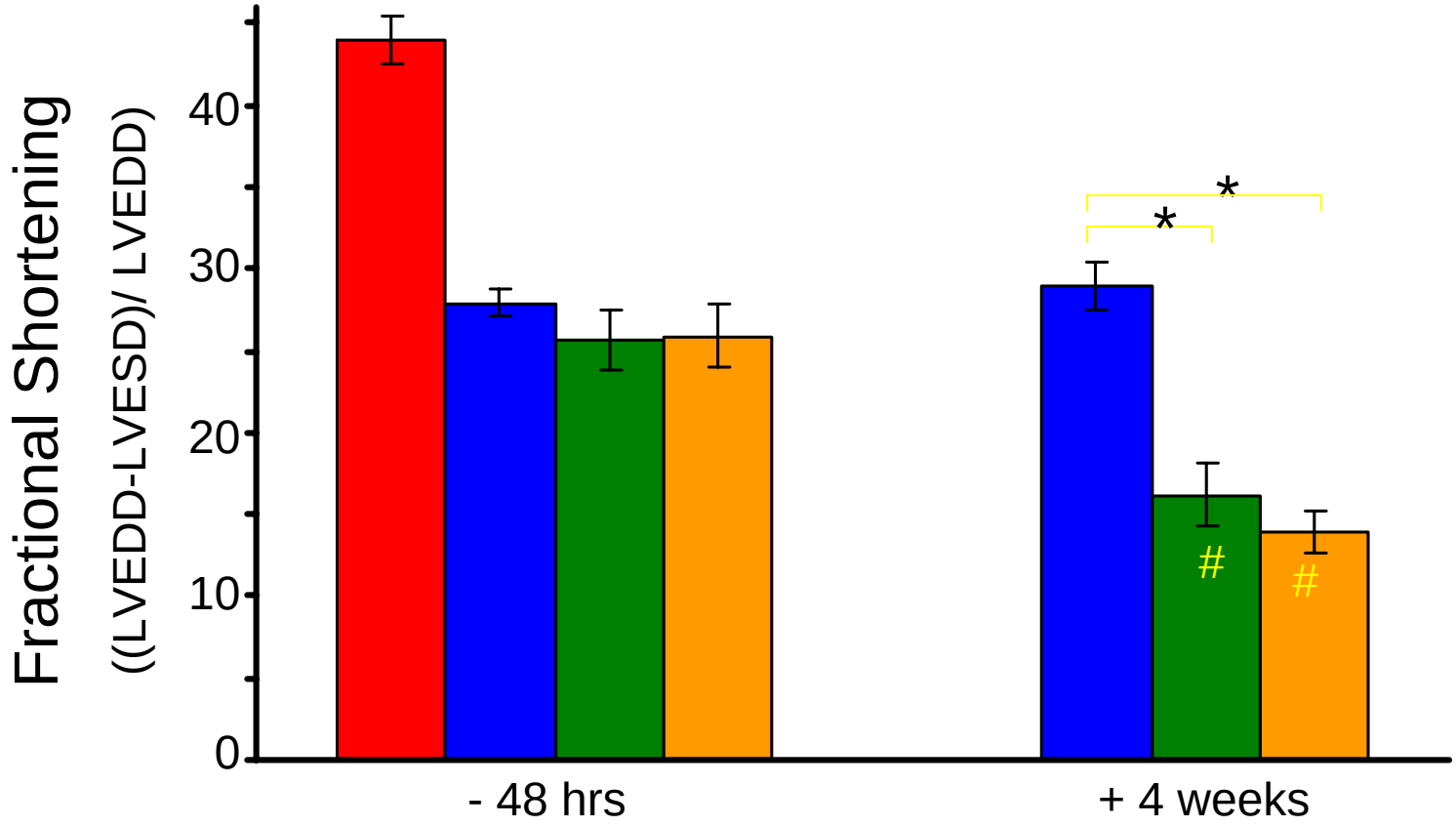
Cardiac MRI in Rodents

Vascular Imaging Lab

(A Naumova, C Yuan, V Yarnykh)

4 Chamber View

Transplanted Human Heart Muscle Preserves Heart Function



11 Uninfarcted

11 Cells + KSM

14 KSM only

8 Serum-fee medium only

* p<0.001 between groups

\# p<0.001 vs. 48 hrs

Conclusion

- Transplanted human heart muscle cells survive and form new muscle tissue in injured heart.
- This prevents the progression of heart failure after a heart attack.

Timelines to the Clinic

- Adult stem cell trials currently underway.
- Embryonic stem cell trials slated to begin next year.

- It could be a decade before we develop truly useful therapies with either cell type.

University of Washington
Institute for Stem Cell and Regenerative Medicine

- Established March 2006
- Mission: translate stem cell research into therapy
- > 80 faculty members, one of largest in the nation
- Multidisciplinary
  - Medicine, Engineering, Arts & Sciences
- Will be based at South Lake Union campus
- $100 M funding goal

States Supporting Human ES Cell Research